

## WHAT IS CLAIMED IS:

1. A highly utilizable protection mechanism for WDM mesh network comprising of;

5 a step of waiting randomly generated channel request which is a request to generate channel between source node and target node,

a step of finding shortest path set within limit of hop length,

10 a step of finding disjointed path set for each path of the shortest path set,

a step of making pairs using shortest path set and disjoint path set for WP and BP,

15 a step of calculating cost by using cost function considering current network state,

a step of sorting the cost lists from minimum cost to maximum cost,

a step of selecting best pair having minimum cost, and

20 a step of checking whether each link has enough capacity to allocate channel resources for the channel request with best working and backup path pair having minimum cost,

wherein said step of calculating cost is as follow;

$$Cost^* = (W_1 \times AC + W_2 \times (WC + BC) + W_3 \times CC)$$

25 , where  $W_1 \ll W_2 \ll W_3$ ,  $W_j$  is much bigger than  $W_i$ ,  $i < j$ ,

$i=\{1,2,\}$  and  $j=\{2,3\}$

, where  $AC = [\sum_{i \in WP} \sum_{j \in BP} (R_{Allocated_i} + R_{Allocated_j})]_{Average}$

where  $R_{Allocated}$  is average rate of previously allocated wavelengths compared to total link capacity in the links passed by WP or BP,

, where  $BC = \min_j (BR_j - SBR_j), j=1, \dots, W$ , where  $BR_j$  is required number of wavelengths for BP reservation in the  $j$ th wavelength number,  $SBR_j$  is the number of sharable wavelength for BP reservation in the  $j$ th wavelength number,

, where  $CC$  (Capacity Cost) = 1 if there is no more wavelength to allocate on a link which WP and BP pass by,

, where  $WC$  (Working path Cost) means the cost of reserving working path.

2. A highly utilizable protection mechanism for WDM mesh network according to claim 1, wherein after said step of checking whether each link has enough capacity, if a result of checking is enough wavelength for both WP and BP, then a step of accepting said channel request, and if not, then a step of rejecting said channel request.

3. A highly utilizable protection mechanism for WDM mesh network comprising of;

a step of producing a shortest path set when channel request is generated, wherein channel request is a request to generate channel between source node and target node,

a step of selecting disjoint path set to select working path and backup path in said path set,

a step of calculating cost by using cost function considering current network state,

a step of selecting best pair having minimum cost, and

a step of allocating resources by checking whether each link has enough capacity to allocate channel resources for the channel request with best working and backup path pair having minimum cost,

wherein said step of calculating cost is as follow;

$$Cost^* = (W_1 \times AC + W_2 \times (WC + BC) + W_3 \times CC)$$

, where  $W_1 \ll W_2 \ll W_3$ ,  $W_j$  is much bigger than  $W_i$ ,  $i < j$ ,  $i=\{1,2\}$  and  $j=\{2,3\}$

$$AC = \left[ \sum_{i \in WP} \sum_{j \in BP} (R_{Allocated_i} + R_{Allocated_j}) \right]_{Average}$$

where  $R_{Allocated}$  is average rate of previously allocated wavelengths compared to total link capacity in the links passed by WP or BP,

, where  $BC = \min_j (BR_j - SBR_j)$ ,  $j=1, \dots, W$ , where  $BR_j$  is required

number of wavelengths for BP reservation in the  $j$ th wavelength number,  $SBR_j$  is the number of sharable wavelength for BP reservation in the  $j$ th wavelength number,

5 ,where CC (Capacity Cost) = 1 if there is no more wavelength to allocate on a link which WP and BP pass by,

,where WC (Working path Cost) means the cost of reserving working path.

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4. A highly utilizable protection mechanism for WDM mesh network comprising of;

a step of waiting randomly generated channel request which is a request to generate channel between source  
15 node and target node,

a step of finding shortest path set within limit of hop length,

a step of finding disjointed path set for each path of the shortest path set,

20 a step of making pairs using shortest path set and disjoint path set for WP and BP,

a step of calculating cost by using cost function considering current network state,

25 a step of sorting the cost lists from minimum cost to maximum cost,

a step of selecting best pair having minimum cost, and  
a step of checking whether each link has enough  
capacity to allocate channel resources for the channel  
request with best working and backup path pair having  
5 minimum cost,

wherein said step of calculating cost calculates cost  
using the sum value of allocated average wavelength  
rate, capacity of allocating resources, and amount of  
necessary resources.

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5. A highly utilizable protection mechanism for WDM  
mesh network according to claim 4,

wherein after said step of checking whether each link  
has enough capacity, if a result of checking is enough  
15 wavelength for both WP and BP, then a step of  
accepting said channel request, and if not, then a  
step of rejecting said channel request.

6. A highly utilizable protection mechanism for WDM  
20 mesh network comprising of;

a step of producing a shortest path set when channel  
request is generated, wherein channel request is a  
request to generate channel between source node and  
target node,

25 a step of selecting disjoint path set to select

working path and backup path in said path set,  
a step of calculating cost by using cost function  
considering current network state,  
a step of selecting best pair having minimum cost, and  
5 a step of allocating resources by checking whether  
each link has enough capacity to allocate channel  
resources for the channel request with best working  
and backup path pair having minimum cost,  
wherein said step of calculating cost calculates cost  
10 using the sum value of allocated average wavelength  
rate, capacity of allocating resources, and amount of  
necessary resources.

7. A highly utilizable protection mechanism for WDM  
15 mesh network,  
wherein said method uses calculated cost; and  
wherein said cost is the sum value of allocated  
average wavelength rate, capacity of allocating  
resources, and amount of necessary resources.

20 8. A highly utilizable protection mechanism for WDM  
mesh network,  
wherein said method uses calculated cost; and  
wherein said cost is as follow;

25 
$$Cost^* = (W_1 \times AC + W_2 \times (WC + BC) + W_3 \times CC)$$

, where  $W_1 \ll W_2 \ll W_3$ ,  $W_j$  is much bigger than  $W_i$ ,  $i < j$ ,  
 $i=\{1,2,\}$  and  $j=\{2,3\}$

, where  $AC = [\sum_{i \in WP} \sum_{j \in BP} (R_{Allocated_i} + R_{Allocated_j})]_{Average}$

where  $R_{Allocated}$  is average rate of previously  
 5 allocated wavelengths compared to total link capacity  
 in the links passed by WP or BP,

, where  $BC = \min_j (BR_j - SBR_j), j=1, \dots, W$ , where  $BR_j$  is required  
 number of wavelengths for BP reservation in the  $j$ th  
 wavelength number,  $SBR_j$  is the number of sharable  
 10 wavelength for BP reservation in the  $j$ th wavelength  
 number,

, where CC (Capacity Cost) = 1 if there is no more  
 wavelength to allocate on a link which WP and BP pass  
 by,

15 , where WC (Working path Cost) means the cost of  
 reserving working path.